Quantifying the carbon balance of lowland peatlands

Ross Morrison, Alex Cumming, Nathan Callaghan, Chris Evans & many, many others

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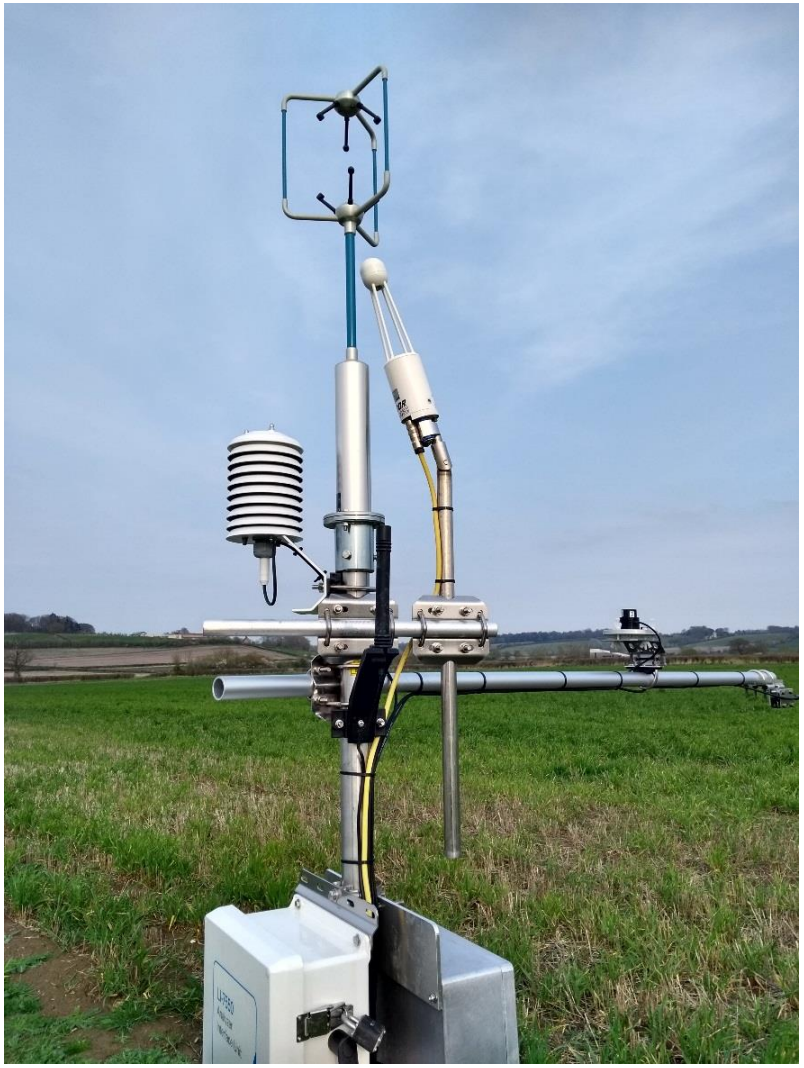
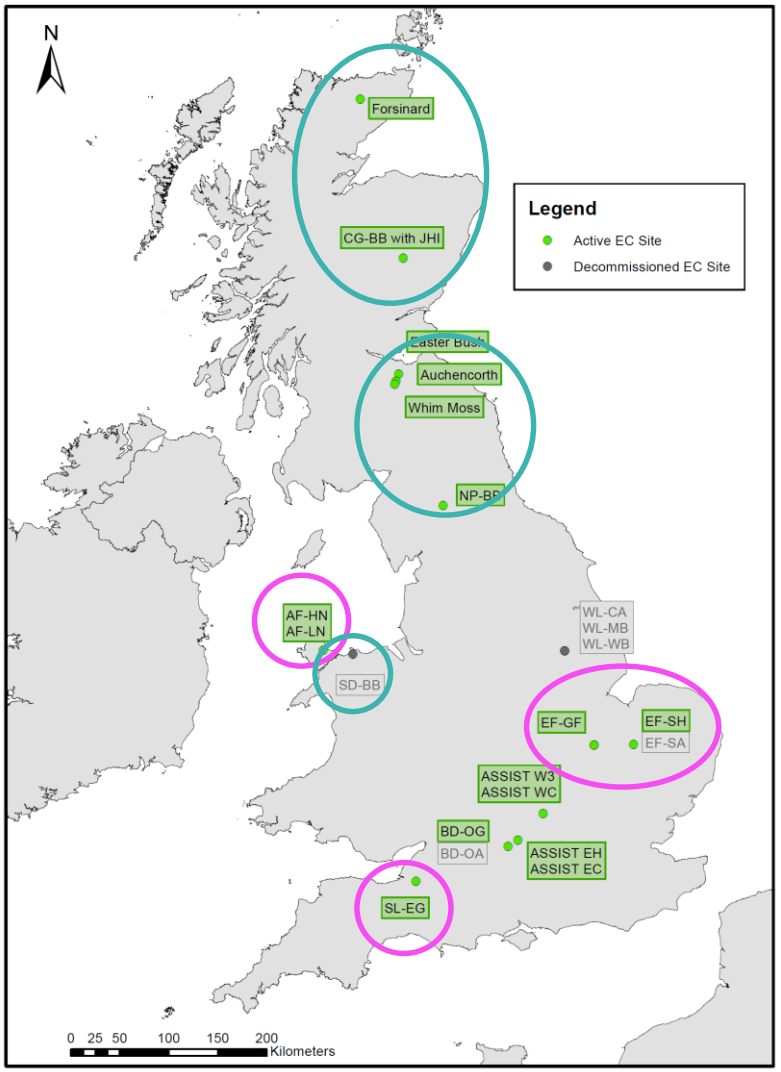
Outline

- Past and current work at UK lowland peatlands (Defra Lowland Peat Phase 1)
- Forthcoming work at lowland agricultural peatlands (Defra Lowland Peat Phase 2)

Eddy covariance flux tower network





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16 active (CEH) sites - 10 at peatland

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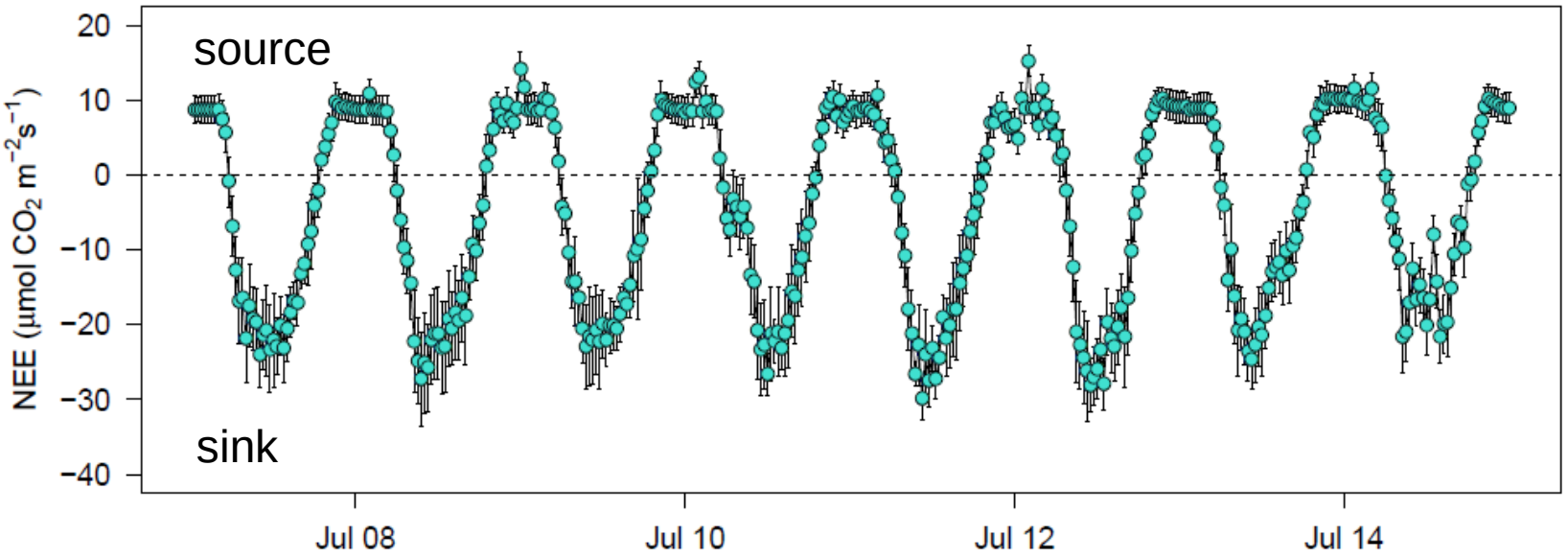
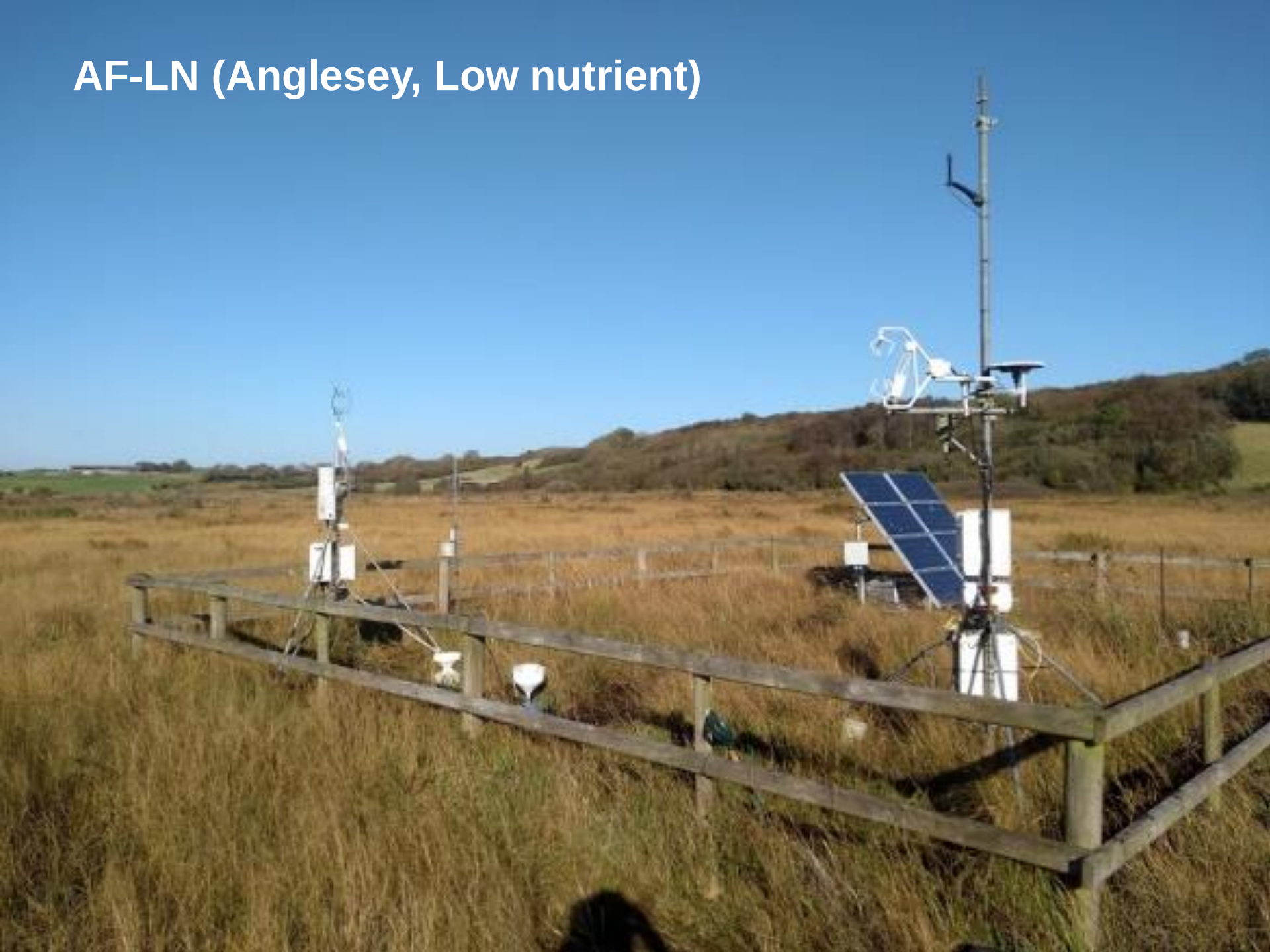
Eddy covariance

- Direct measurement of land to atmosphere fluxes (water, CO_2, CH_4, energy, etc.)
- Whole ecosystem dynamics
- Quasi-continuous (thirty minute) flux densities
- Large upwind source area (flux footprint)



AF-LN (Anglesey, Low nutrient)



Managed Grassland: Somerset Levels


Cropland, East Anglia

Soil loss & land subsidence

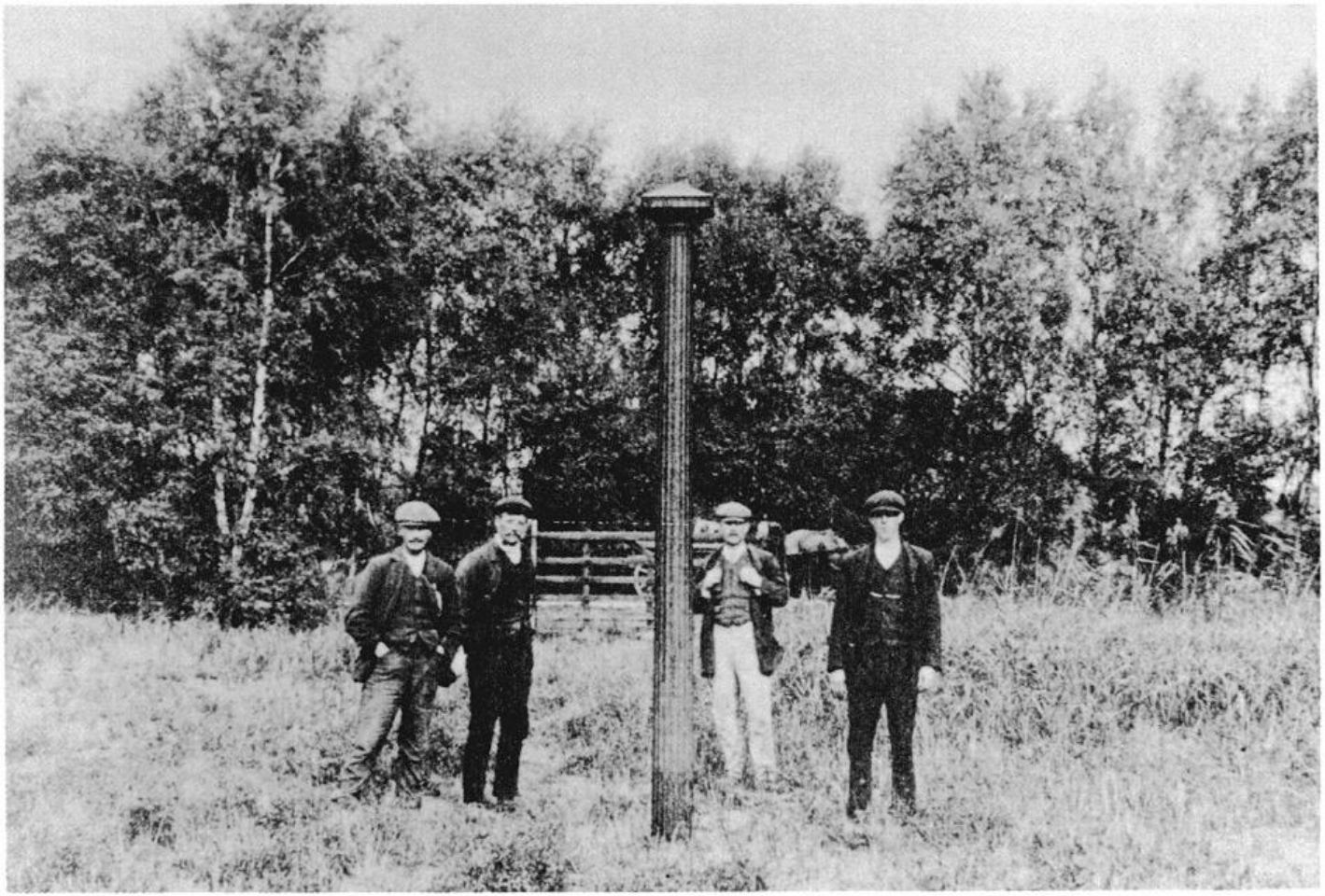


PLATE 4. Holme Post (protruding *c.* 3·0 m). Photograph taken not later than 1913, and probably between 1910 and 1913, looking NW (with acknowledgments to Cooper Square Publishers, N.Y.).

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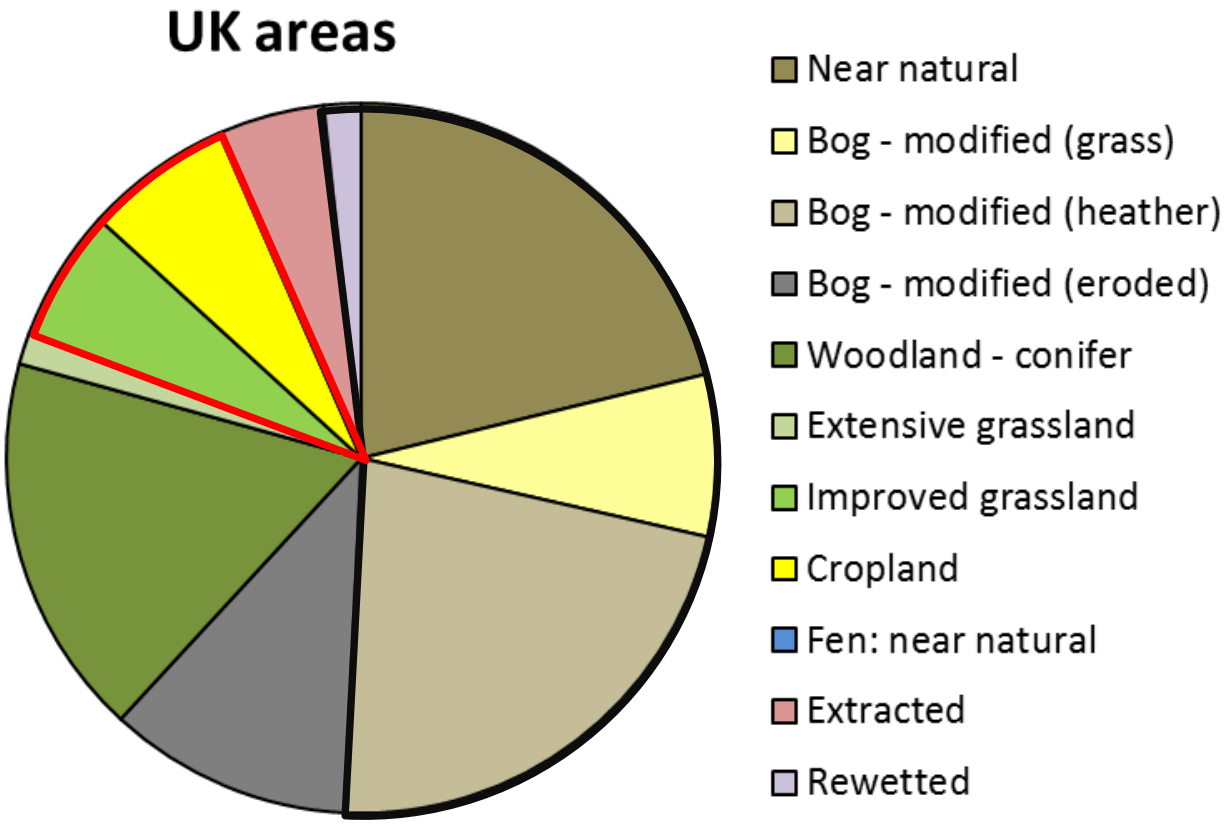
Hutchinson, J. N. (1980) The Record of Peat Wastage in the East Anglian Fenlands at Holme Post, 1848-1978 A.D. *Journal of Ecology.* **68** (1)

UK peat emissions inventory

UK peatland condition, circa 2013

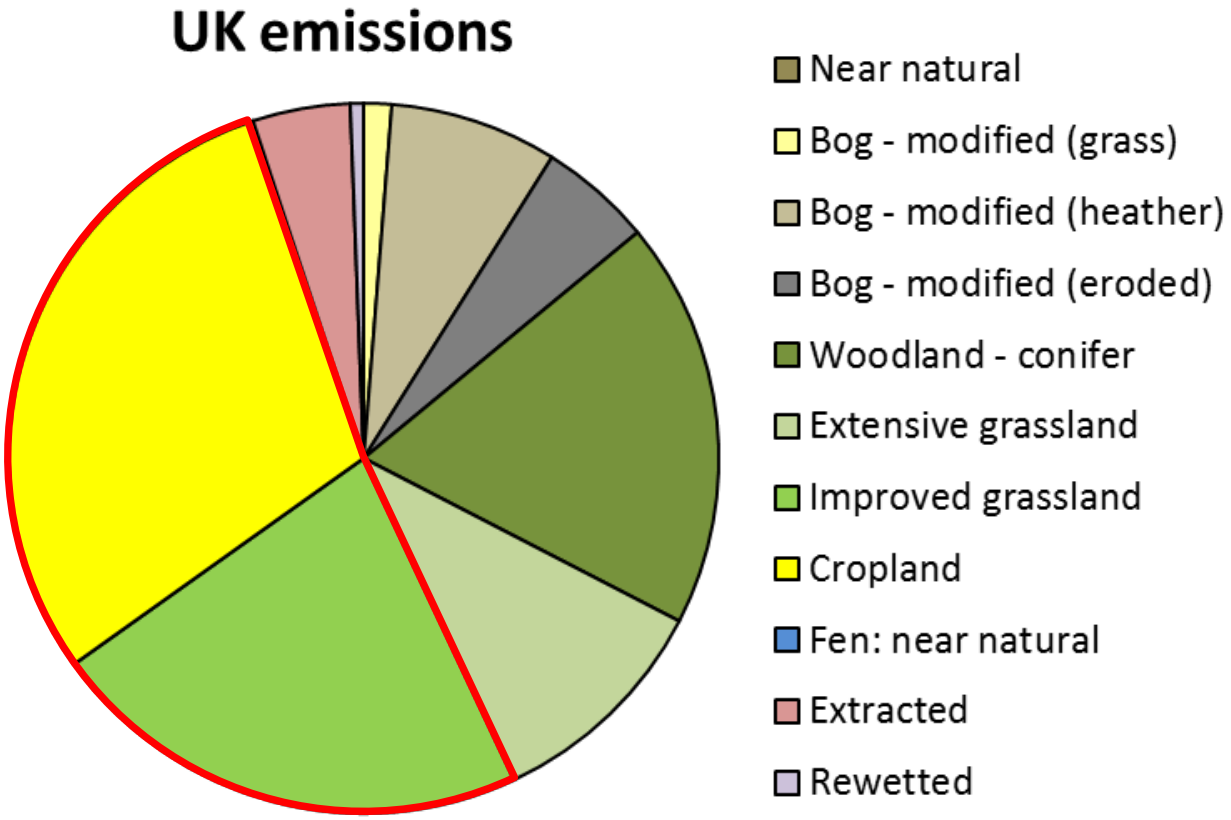
- Around 50% of UK peatland is still in a semi-natural condition (mostly in the uplands
- **Agricultural peatlands comprise < 15% of the total peat area (all in the lowlands)**



UK peat emissions inventory

Total GHG emissions from UK organic soils

- Total emissions estimated to be 23 Mt CO_2e yr^{-1}
- This is around 4% of UK total GHG emissions
- **Over 50% of UK peat GHG emissions are from intensive agricultural land**
- These areas occupy <2% of the total UK land area



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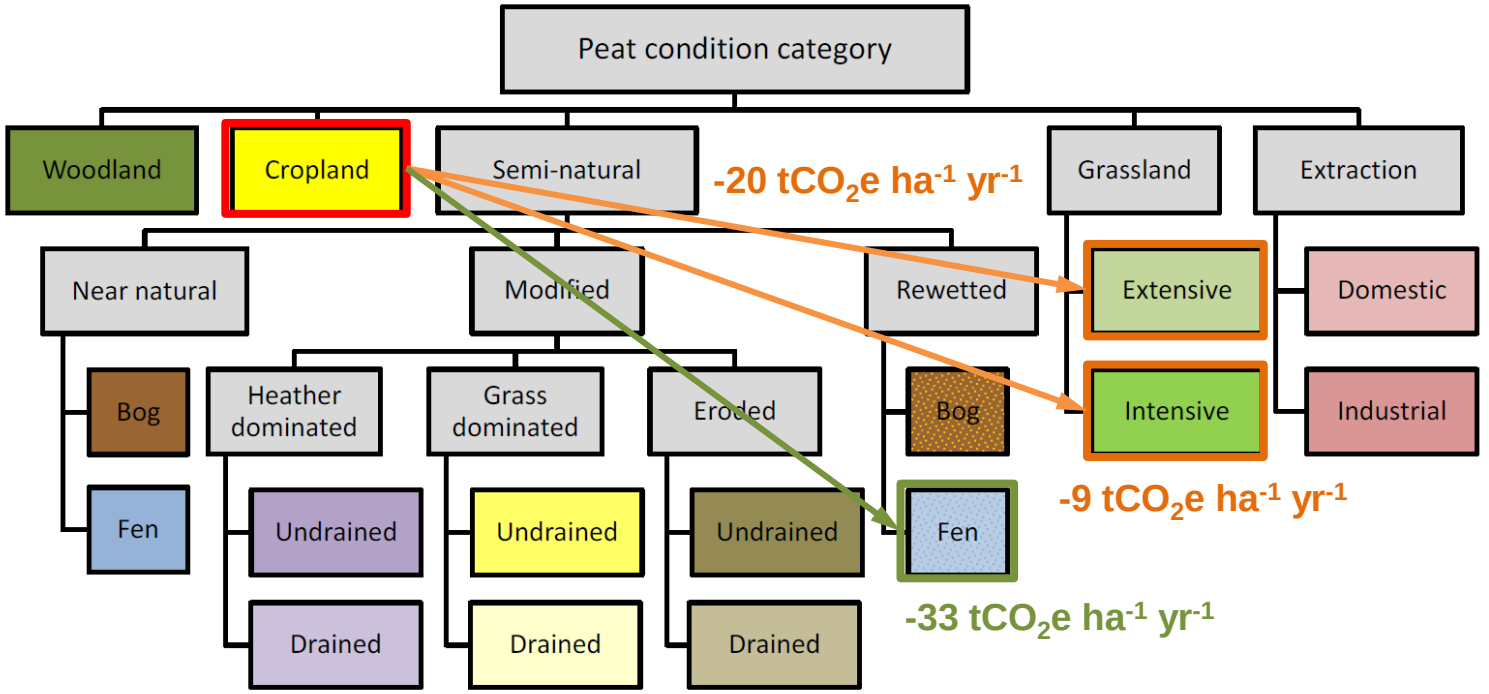
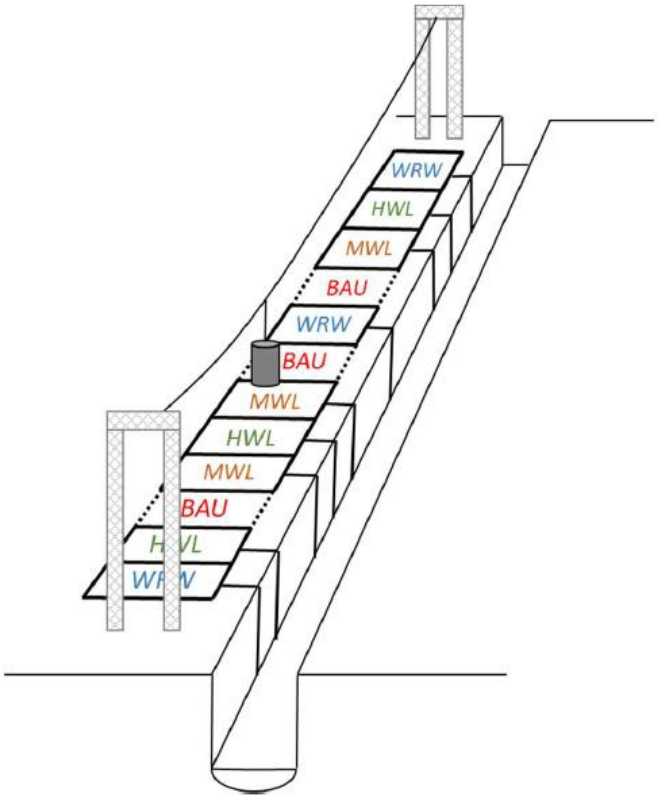
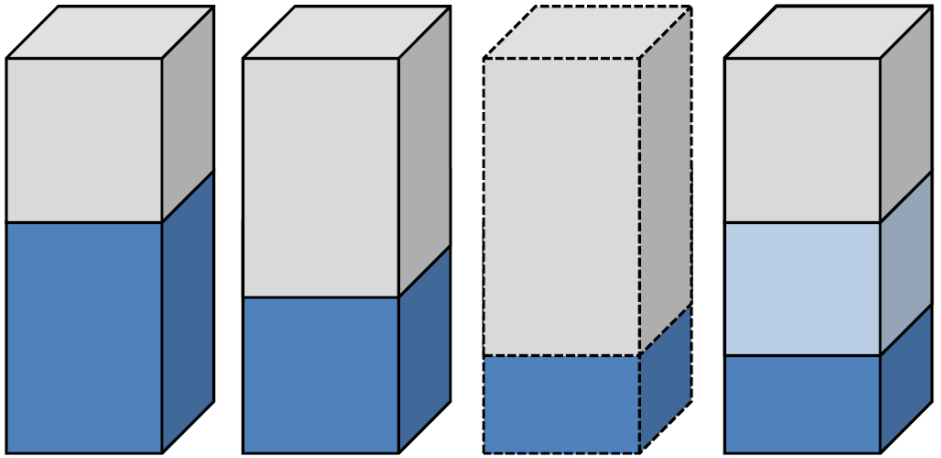
Cropland mitigation – all or nothing?



- Barriers to progress:
- Farmers do not want to stop farming
- Paludiculture not currently seen as a viable or economic alternative
- No reward for raising water levels in agricultural peatland

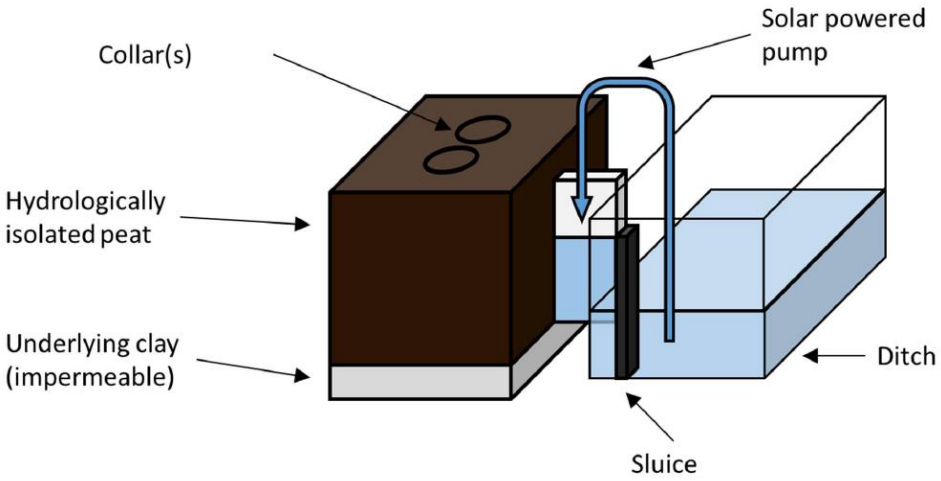
LP2: Water level manipulation experiment





High WL	Medium WL	Low WL (BAU)	Winter re-wetting
30 cm	60 cm	~90 cm*	30/90 cm

*BAU treatment planned to reflect conditions in wider field (i.e. plots not hydrologically isolated). Alternative would be a fixed 90 cm WL (greater hydrological control, less realistic)



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Skyline-2D: greenhouse gas (CO_2, CH_4, N_2O) measurement system

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New flux site: Deep agricultural peat (EF-NE)

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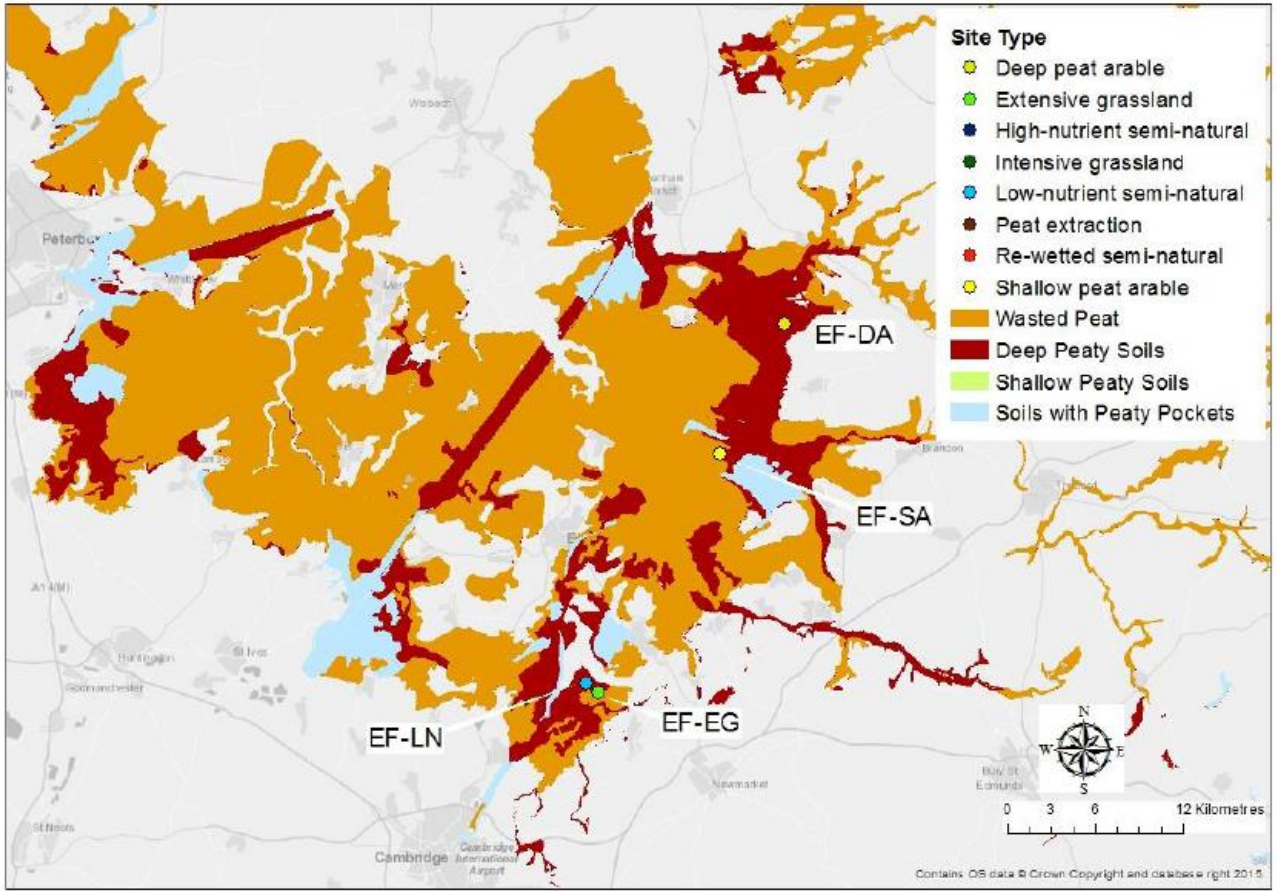
What about ‘skirtland’…?



Evans et al. (2016) based on map data from Natural England (2010)

New flux site: Skirtland (EF-SK)

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Summary

- Ongoing (and forthcoming) flux tower work to quantify the carbon balance of lowland peatlands under different land use
- Experimental work focused on real-world solutions to mitigate emissions from lowland agricultural peatland